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NEW INFORMATION ON THE MIDDLE EOCENE FISHFAUNA OF MESSEL PIT

Messel Pit is the remainder of a former open-cast mining, in which oilshales were quarried for the production of crude oil until the end of 1971. The pit is close to the small village of Messel, approximately 9 km NE of Darmstadt (Hessian State, S Germany). The oilshales are some 49 million years old (Middle Eocene, Early Geiseltalian; mammal unit MP11). They consist of laminated claystone and were deposited at the bottom of a small, warm subtropical lake, which was formed during the incipient rifting of the Upper Rhine Valley System (Oberrheingraben). This lake was probably part of a drainage system, in which it acted as a settling tank for argillaceous sediments as well as floating carcasses.

The locality yielded a highly diverse vertebrate and invertebrate fauna, amongst them the world-famous „Urpferdchen“ of the genus *Propalaeotherium* (e.g., Franzen, 1985). Nevertheless, there also are numerous nice fish fossils. Seven nominal genera and species as yet were described (Micklich, 1992; Grande & Micklich, 1993): Bowfins (*Cyclurus kehrerei*) and gars (*Atractosteus strausi*) generally are the most frequent records. Recent species are recognised as „Living Fossils“, representing the most initial types among extant bony fishes. *Thaumaturus intermedius* and *Anguilla ignota* are teleosts, in which they, however, represent comparatively primitive families. Percoids are the most diversified component of the Messel ichthyofauna. Respective finds are more rare than those of the other fish species. *Amphiperca multiformis* corresponds with deep-bodied, manoeuvrable ambush-hunters, the fusiform specimens of *Palaeoperca proxima* are more likely to represent more active and permanent swimmers. Specimens of *Rhenanoperca minuta* appear to have been specialists with massive „grinding teeth“, a presumed specialisation for feeding on hard-shelled prey.

There is a considerable degree of morphological variation within the Messel ichthyofauna. Within most species there are individuals that markedly differ from all other specimens in the development of certain skeletal features. Concerning the percoids, it was pointed out that this phenomenon is best explained as the result of a process similar to intralacustrine speciation and that the fossil record of Messel Lake percoids probably is a mixture of several closely related species (Micklich, 1996).

Against this background, research projects were started concerning *Atractosteus strausi* and *Thaumaturus intermedius* in order to complete the informations concerning their morphology, ecology and to get tools for further tests of the speciation hypothesis.

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Atractosteus strausi: This species was removed from the genus *Lepisosteus*, e.g., because of the infraorbital enameloid covering, which was considered to be reduced in comparison to Recent *Lepisosteus*, as well as the presence of „enlarged dermopalatine fangs“ (Wiley, 1976). The Messel species clearly has thicker enameloid on the infraorbitals than extant *Lepisosteus* (e.g., *L. osseus*). The generic association, however, is not put into question as yet. There is an obvious need for reviewing gar systematic and results of current research projects (Grande & Bemish, in prep.) remain to be seen. As a matter of fact, some characters of Messel gars fit with the definitions of Wiley (1976: 81), but there also are characters (e.g., presence of fulcral scales in front of the pelvics) which oppose against a classification as Ginglymodi (Wiley, 1976: 39). Furthermore, there is a high degree of morphological variation. One new species is present for sure and the assemblage may yield further diversification. The new species was first detected by its snout, which is distinctively shorter than in the “regular” Messel Gars. This character was put into doubt at first, because the anterior snout portion was damaged in all respective specimens. Later on, it was proved that there was no significant loss of substance, and additional diagnostic characters were found: e.g., presence of five lacrimals; lack of tooth-bearing infraorbitals; short ascending process of premaxilla; wide lower jaws with large coronoid process; small, roundish teeth on lower jaw elements; (probable) lack of plicidentine; narrow orbit; large supraorbital and dermosphenotic; thick, continuous enameloid covering on skull and opercular bones; sensory canal elements with numerous pore openings; vertical limb of preopercle covered by enameloid and laterally projecting between suborbitals and opercle; large and dorsally expanded dermohyal.

Thaumatodus intermedius has passed through a remarkable taxonomical odyssey (Micklich, 1992): Originally it was classified as member of the Salmoniformes. Later on, it was noticed that this classification was based on misinterpretations (e.g., presence of an adipose fin) and the species was transferred to the Osteoglossiformes. According to more recent hypotheses, it belongs to the Ostariostomidae, which are considered as sister family of Notopteridae within the notopteroids (Li & Wilson, 1996; Li, Wilson & Grande 1997; Li, Grande & Wilson, 1997; Zhang 1998). Current investigations (Micklich & Arratia, in prep.), however, point out that Messel *Thaumatodus* cannot belong to the ostariostomids, notopteroids or osteoglossomorphs as defined in the just mentioned papers: Two character states (preoperculo-mandibular canal on vertical arm of preopercle enclosed in a bony tube, presence of supraneurals), at least, contradict a classification as Ostariostomidae; five character states (lack of infraorbital ledge, infraorbital canal on Io 1 running in a superficial bony tube, preoperculo-mandibular canal on horizontal arm of preopercle enclosed in a bony tube, caudal fin supports with six hypurals and two uroneurals; the latter character is regarded as an extraordinary one in literature) contradict a classification as Notopteroidei; three character states (16 branched caudal rays; u 1 without neural spine, dorsal arm of posttemporal very much longer than ventral one), at least, contradict the classification as Osteoglossiformes; and four character states (primary bite between basihyal and endopterygoid, parasphenoid without teeth; presence of supraorbital, separate fourth and fifth infraorbitals, pu 1 without neural spine) contradict the classification as Osteoglossomorpha. Further characters (parietals medially separated by frontals; premaxilla expanded, maxilla almost excluded from gape, infraorbitals three and four narrow, not covering large portions of the cheek region) also exclude Messel

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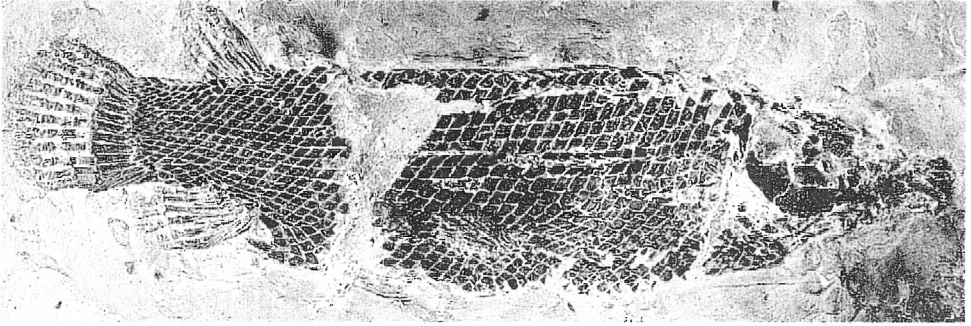


Fig. 1. *Lepisosteidae* n.g., n.sp. Specimen HLMD-Me 12616, total length 27 cm.

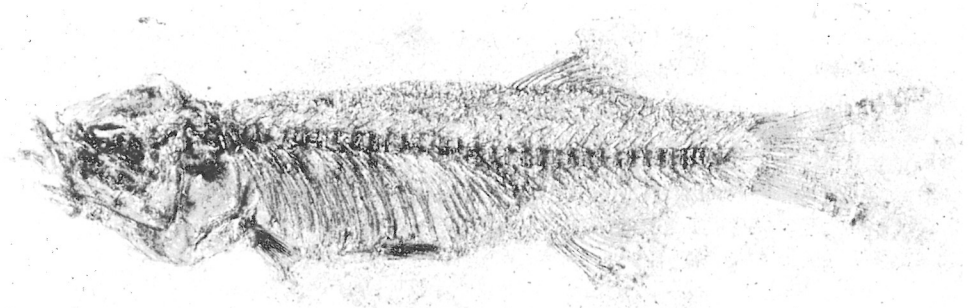


Fig. 2. *Thaumaturus intermedius* Weitzel. Specimen HLMD-Me 7954, total length 5,5 cm.

Thaumaturus from most Osteoglossomorpha. One feature was found (posterior maxillar process, probably resulting from a fusion with the autopalatine) which may be an autapomorphy of the Thaumaturidae. *Thaumaturus intermedius* Weitzel is characterised by an extraordinary degree of morphological variation and the nominal species may be a multi-species assemblage, too.

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